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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/809,663	03/15/2001	Mukesh V. Khare	FIS920000396US1 / I30-000	5741

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INTERNATIONAL BUSINESS MACHINES CORPORATION  
DEPT. 18G  
BLDG. 300-482  
2070 ROUTE 52  
HOPEWELL JUNCTION, NY 12533

EXAMINER

TOLEDO, FERNANDO L

ART UNIT	PAPER NUMBER
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2823

DATE MAILED: 09/17/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

09/809,663

Applicant(s)

KHARE ET AL.

Examiner

Fernando Toledo

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 20 June 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-3 and 6-8 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 6-8 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

**Priority under 35 U.S.C. §§ 119 and 120**

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                             | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

## **DETAILED ACTION**

### ***Claim Rejections - 35 USC § 102***

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Kraft et al. (U. S. patent 6,136,654).

In re claim 1, Kraft in the U. S. patent 6,136,654; figures 1 – 8 and related text discloses forming an initial oxynitride layer 14 upon a substrate material, the oxynitride layer having an initial physical thickness (column 3, lines 52 – 56); subjecting the initial oxynitride layer to plasma nitridation, the plasma nitridation resulting in final oxynitride layer, the final oxynitride layer having a final physical thickness (column 3, lines 59 – 67 and column 4, lines 1 – 11); wherein the final oxynitride layer has a nitrogen concentration of 0.1 to 57 atomic % (column 5, lines 24 – 28); wherein the final oxynitride layer has an equivalent oxide thickness of less than 15 Å and a nitrogen concentration of at least  $2.0 \times 10^{15}$  atoms/cm<sup>2</sup> (figure 7).

### ***Claim Rejections - 35 USC § 103***

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
4. Claims 2 – 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kraft as applied to claims 1 and 5 above.

In re claim 2, Kraft does not show wherein the final physical thickness exceeds the initial thickness by less than 5 Å.

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However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the final physical thickness exceeds the initial thickness by less than 5 Å in the invention of Kraft, since insulation thicknesses are well-known process variables and finding the optimum or workable ranges of those thicknesses requires only ordinary skill in the art. Note that the specification contains no disclosure of either the critical nature of the claimed thicknesses or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen thicknesses or upon another variable recited in a claim, the Applicant must show that the chosen thicknesses are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

In re claim 3, Kraft does not disclose wherein the final physical thickness is less than 20 Å.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the final physical thickness less than 20 Å in the invention of Kraft, since insulation thicknesses are well-known process variables and finding the optimum or workable ranges of those thicknesses requires only ordinary skill in the art. Note that the specification contains no disclosure of either the critical nature of the claimed thicknesses or any unexpected results arising therefrom. Where patentability is said to be based upon particular chosen thicknesses or upon another variable recited in a claim, the Applicant must show that the chosen thicknesses are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

5. Claims 6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kraft as applied to claims 1 and 5 above, and further in view of Ito et al. (U. S. patent 4,980,307).

In re claim 6, Kraft does not teach wherein the initial oxynitride layer is formed upon the substrate by ionically implanting nitrogen atoms into the substrate and oxidizing the substrate, following the substrate being ionically implanted with nitrogen atoms.

However, Ito in the U. S. patent 4,980,307 discloses forming an oxynitride layer wherein the substrate is nitrated (by plasma) followed by an oxidation treatment, which allows for an increased thickness of the initial oxynitride layer (columns 6 and 7).

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the initial oxynitride of Kraft by the method of Ito since it allows for an increased thickness of the initial oxynitride layer.

In re claim 8, Kraft in view of Ito does not show wherein the final oxynitride layer further has a reduction effective electron mobility,  $\mu_{\text{eff}}$ , of less than 20% from the effective electron mobility of the initial oxynitride layer.

However, since Kraft in view of Ito disclose the invention it would have been obvious to one having ordinary skill in the art at the time the invention was made to achieve the same reduction in effective electron mobility since the effective electron mobility is a direct result of the formation of the final oxynitride layer.

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kraft as applied to claims 1 and 5 above, and further in view of Gusev et al. ("Growth and characterization of ultrathin nitrided silicon oxide films" pp 1 – 22).

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Kraft does not disclose wherein the initial oxynitride layer is formed upon the substrate by rapid thermal nitric oxide deposition.

However, Gusev in the article "Growth and Characterization of Ultrathin Nitrided Silicon Oxide Films, pp 1 – 22 discloses that by forming the oxynitride film with a rapid thermal nitric oxide deposition, the nitrogen is more effectively incorporated in the dielectric film than by using N<sub>2</sub> or N<sub>2</sub>O (pages 8 and 9).

Therefore It would have been obvious to one having ordinary skill in the art at the time the invention was made to form the initial oxynitride film of Kraft by the method of Gusev, because the nitrogen is more effectively incorporated in the dielectric film than by using N<sub>2</sub> or N<sub>2</sub>O.

### ***Response to Arguments***

7. Applicant's arguments filed June 20, 2003 have been fully considered but they are not persuasive for the following reasons.

Applicant contests that Kraft et al. fails to disclose that after subjecting the oxygen-containing layer to a nitrogen-containing plasma, the layer has an equivalent oxide thickness of less than 15 Å and a nitrogen concentration of at least  $2.0 \times 10^{15}$  atoms/cm<sup>2</sup>.

Examiner respectfully submits that Figures 7 and 8 are only examples of a preferred method of Kraft. Kraft gives a range of the different parameters that can be changed to optimize the oxynitride layer. Kraft discloses that the starting oxide-containing layer should be 10 – 150 (presumably Å) thick and more preferably 10 to 45 Å (Column 4, Lines 45 – 48). Also the plasma parameters are given in ranges as an example the nitrogen gas flow is from 1 to 100 sccm

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(Column 4, Lines 5 – 10). Since Kraft discloses various ranges for the parameters to form the oxynitride, it is logical to assume that one of the many possible combinations of Kraft's parameters will result in Applicant's invention.

### ***Conclusion***

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fernando Toledo whose telephone number is 703-305-0567. The examiner can normally be reached on Mon-Fri 8am to 4pm.

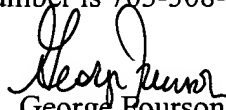
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on 703-306-2794. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

  
George Fourson  
Primary Examiner  
Art Unit 2823

  
FToledo